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UNITED STATES ARMY AVIATION BOARD
Fort Rucker, Alabama

(14) STEBG-AVAB-AVN-4362

(1) 19 NOV 1962

SUBJECT: Report of Test, Project No. ATDEV-6, Evaluation of the
Flight Line Analyzer for the AN/ASW-12(V) Automatic
Flight Control System

(11) 19 Nov 62

(12) 8P

TO: Commanding General
United States Army Test and Evaluation Command
Aberdeen Proving Ground, Maryland

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1. AUTHORITY.

a. Directive. Letter, ATDEV-6, Headquarters, USCONARC,
11 July 1962, subject: "Evaluation of the Flight Line Analyzer for the
AN/ASW-12(V) Automatic Flight Control System."

b. Purpose. To conduct an evaluation of the Sperry Gyroscope
Company flight line analyzer for the AN/ASW-12 Automatic Flight Control
System (AFCS) to determine if this item has sufficient military value to
warrant further Army interests.

2. BACKGROUND.

a. A flight line analyzer, part of the Special Test Equipment
Kit for the AN/ASW-12 (V) AFCS, was developed by the US Army Signal
Corps under contract with the Sperry Phoenix Company, Phoenix,
Arizona, in accordance with the Signal Corps Technical Requirement
for Automatic Pilot Test Set (SCL-4219), 2 March 1960. It was designed
as a GO-NO GO testing device to be used at the organizational maintenance level.

b. The Department of Army Combat Development Objectives
Guide contains no separate Statement of Requirement for a flight line
analyzer for the AN/ASW-12 (V).

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c. Engineering tests of a flight line analyzer designed in accordance with military specifications are now in progress at Fort Monmouth. The flight line analyzer evaluated was not designed in accordance with military specifications. According to representatives from US Army Signal Research and Development Laboratories and the Sperry Phoenix Company, the analyzer is one of a limited number which were procured on an expedited basis to fulfill an urgent requirement for flight line analyzers in Europe. Results of engineering tests of this item have not been made available to this Board.

d. The flight line analyzer provided for test was received in November 1961. However, testing of the equipment could not be initiated until an AO-1() airplane was modified in accordance with Grumman Engineering Change Proposal (ECP) GR-AO-103, "Revision of AN/ASW-12 Wiring to Accommodate Flight Line Analyzer," in order to provide compatibility with the flight line analyzer.

3. DESCRIPTION OF MATERIEL.

a. The test flight line analyzer was designed to provide a means of testing the AN/ASW-12(V) AFCS in an airplane. It isolates faulty components causing system malfunction. The test sequence singles out the key AFCS components and functions and subjects them to complete evaluation. The remaining units are then evaluated and isolated by means of functional tests on a series of components. In some cases the faulty component is not subjected to any direct functional tests but is isolated by means of determining the acceptability of all other components.

b. Cables are provided from the airplane's test point to the cockpit of the aircraft, which enables one person to operate both the flight line analyzer and the AN/ASW-12(V).

c. Electrical power for operation of the flight line analyzer is obtained from the airplane's electrical systems.

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4. TESTS. The US Army Signal Aviation Test and Support Activity, in conjunction with the US Army Aviation Board, evaluated the flight line analyzer, using the AN/ASW-12(V) installed in an AO-1C Airplane. The evaluation was conducted during the period April-August 1962.

a. Physical Characteristics.

(1) Size and Weight. The flight line analyzer measured 11 inches by 27 inches by 15 inches and weighed 26 pounds. Additionally, the two cables provided to connect the analyzer to the aircraft's test receptacle were 15 feet long and weighed 9 1/2 pounds.

(2) Ruggedness. The manufacturer's representative located at this station has stated that the analyzer furnished for this evaluation was not designed to be rugged enough for sustained operation under military field conditions. Therefore, during the evaluation, the equipment was not subjected to thorough user ruggedness tests.

(3) Power Requirements. It was not possible to measure the power requirements of the analyzer without cutting wires inside the case. Therefore, no effort was made to measure the power requirements. The analyzer requires both 28-volts d.c. and 115-volts, 400-cycle a.c. power.

b. Operational Characteristics.

(1) Accuracy and Reliability. No unsatisfactory operations were encountered during the evaluation. Malfunctions were injected into components of the AN/ASW-12(V) and in all cases, the malfunctions were detected by the flight line analyzer.

(2) Ease of Operation and Handling Under Existing Weather Conditions.

(a) The two cables provided for connecting the flight line analyzer to the AN/ASW-12 test receptacle on the AO-1 airplane were insufficient length to permit operating the analyzer in the cockpit of the airplane. During the evaluation, the airplane's test receptacles

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were moved forward from the avionics compartment to the baggage compartment. This permitted operation of the analyzer in the cockpit. Recommendations to revise the airplane installation have been forwarded (reference e).

(b) The analyzer was easy to operate and handle. Since the analyzer was operated in the cockpit of the airplane, existing weather conditions did not affect its operation.

(c) Adequacy of the Controls and Indicators. The position, size and functions of the controls and indicators of the flight line analyzer were adequate.

(d) Suitability of Illumination During Night Operations. No integral lighting was provided. Placing light on the control panel of the analyzer created difficulty in interpreting the positions of the controls and indicators and reading the instructions.

(e) Interference to or From Other Electronic Devices. No interference was encountered during the test.

c. Operational Suitability.

(1) Suitability for Use with Various Types of Army Aircraft. The flight line analyzer evaluated could be used only with the AN/ASW-12 in an AO-1 airplane. The manufacturer's representative has stated that the analyzer designed to military specifications can be used with the single-axis AN/ASW-12 installed in HU-1B Helicopters and other aircraft which are equipped with the proper test receptacles.

(2) Capabilities Provided by this Equipment. The flight line analyzer provides the capability of checking the operational status and isolating faulty, major components of the AN/ASW-12 AFCS at the organizational maintenance level. These components can be sent to a field maintenance organization where more sophisticated test equipment is available to determine faulty parts in the major component. It is the opinion of project personnel that since approximately 30 minutes are required to subject the AN/ASW-12 to a complete operational analysis,

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a flight line analyzer would be used as a pre-flight test device only if the mission of the airplane was dependent upon satisfactory AFCS performance, i.e. a surveillance mission using the side-looking airborne radar.

d. Personnel.

(1) Operator. Approximately eight hours of on-the-job training are required for an Aviation Electronic Equipment Mechanic, MOS 284.1, who is familiar with the AN/ASW-12(V) AFCS, to be qualified in the operation of the flight line analyzer.

(2) Maintenance.

(a) Organizational. Aviation Electronic Equipment Mechanic, MOS 284.1, can perform preventive maintenance of the flight line analyzer.

(b) Field. Aviation Electronic Equipment Repairman, MOS 284.2, at fourth-echelon level, will be required to perform maintenance of the flight line analyzer.

(3) Adequacy of the Operating and Maintenance Instructions. The operating and maintenance instructions for the flight line analyzer were incomplete and incorrect.

e. Maintenance.

(1) Design Deficiencies Prejudicial to Ease of Maintenance. No deficiencies were noted. All components of the analyzer were readily accessible for inspection, removal, and parts replacement.

(2) Parts Standardization. The components of the flight line analyzer are non-standard Signal items and are not available through Signal supply channels.

(3) Tools and Test Equipment. Tools and test equipment normally found at fourth-echelon level should be adequate for field maintenance of the flight line analyzer.

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(4) Man-Hours. No data on man-hours expended performing weekly preventive maintenance were accumulated. However, weekly preventive maintenance, which consists of inspection controls and cables, was not considered excessive.

(5) Repair Operation. No repair operations were required during the evaluation.

f. Findings. The following deficiencies and shortcoming were noted:

(1) Deficiencies.

(a) The flight line analyzer could be used only with an AN/ASW-12 installed in an AO-1.

(b) The flight line analyzer contains components which are non-standard items.

(2) Shortcoming. There was no provision for illuminating the flight line analyzer.

5. DISCUSSION.

a. No appreciable benefit has been realized from testing the flight line analyzer furnished for this evaluation. USASRDL has, throughout the development and testing of the AN/ASW-12 emphasized the universal aspects of the AFCS in that it can be used in many different configurations -- one-through five-axis -- in both airplanes and helicopters. The flight line analyzer tested lacked universality in that it is only compatible with the three-axis airplane configuration.

b. Informal information received from USASRDL has revealed that an AN/ASW-12 flight line analyzer developed in accordance with military specifications will be available for service test in approximately three months. It is understood that this flight line analyzer will be compatible with the various AN/ASW-12 configurations and will contain standard components.

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6. CONCLUSIONS.

a. A flight line analyzer for the AN/ASW-12(V) AFCS has sufficient value to warrant further Army interests.

b. The flight line analyzer furnished for this evaluation is unsuitable for Army use.

7. RECOMMENDATIONS. It is recommended that, upon successful completion of engineering tests, a flight-line analyzer for the AN/ASW-12(V) AFCS designed in accordance with military specifications, and without the deficiencies and shortcoming listed in paragraph 4f, be furnished this Board for service test.

8. REFERENCES.

a. Operator's and Organizational Maintenance Manual, Test Set, Analyzer, Flight Line, Sperry Part No. 2592034, Part I and Part II, 1961.

b. Technical Instruction Manual, Test Set, Analyzer, Flight Line, Sperry Part No. 2592034, Part I and Part II, 1961.

c. Signal Corps Technical Requirement, Automatic Pilot Test Sets, SCL-4219, 2 March 1960.

d. Letter, EBGSA/4b, US Army Signal Aviation Test and Support Activity, 19 September 1962, subject: "Letter Report, USASATSA Project No. 61-61, 'Evaluation of Special Test Equipment for AN/ASW-12 Automatic Flight Control System.' "

e. Letter, EBGSA/4b, US Army Signal Aviation Test and Support Activity, 13 September 1962, subject: "Recommended Changes to Engineering Change Proposal GR-AO-103, Revision of AN/ASW-12 Wiring to Accommodate Flight Line Analyzer Test Set."

A. J. Rankin
for *A. J. Rankin*
A. J. RANKIN
Colonel, Armor
President

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Copies Furnished:

**CG, US Army Electronics Command
Fort Monmouth, N. J.**